UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/911,139	07/23/2001	Ruediger Bauder	BAUDER 1-1-1	2375

47396 7590 05/30/2006

HITT GAINES, PC
AGERE SYSTEMS INC.
PO BOX 832570
RICHARDSON, TX 75083

EXAMINER	
TRAN, KHANH C	

ART UNIT	PAPER NUMBER
2611	

DATE MAILED: 05/30/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/911,139	Applicant(s) BAUDER ET AL.	
	Examiner Khanh Tran	Art Unit 2611	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *09 March 2006*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-20* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *11/15/2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

1. The Amendment filed on 03/09/2006 has been entered. Claims 1-20 are pending in this Office action.

Response to Arguments

2. Applicant's arguments filed on 03/09/2006 have been fully considered but they are not persuasive.

Applicants argue on pages 2-3 that Cova provides no teaching or suggestion Figure 4 discloses a transmitter and a receiver and Cova discloses that Figure 4 is a block diagram of a transmitter using predistortion system employing a dedicated feedback loop. Applicants further argue that neither Wessel nor Wright cure this deficiency of Cova.

The Examiner's position is that Applicants' arguments are not persuasive. Even thought Cova does not explicitly teach in US Patent '390' that the transmitter includes a receiver. However, in column 4 lines 40-45, Cova teaches the linear transmitter 400 in figure 4 is adapted for use as a paging transmitter in a paging system, although it can be used in any radio frequency (RF) application. In light of the foregoing teachings, one of ordinary skill in the art would have recognized that the linear transmitter 400 in figure 4 is part of a transceiver for transmission and reception. Furthermore, for practical

reasons, one of ordinary skill in the art would have recognized that the feedback loop as taught in figure 4 of Cova invention employ a receiver as a feedback loop since the feedback loop would include the same components of a receiver. To reinforce the aforementioned reasoning, Wright et al., in column 34 lines 45-40, teaches that in order to implement the monitoring and correction mechanism a small amount of the output signal of the quadrature combiner is directed to a receiver, using a directional coupler as shown in figure 26. The receiver converts the RF signal down to complex baseband samples, which can be compared with samples of the ideal signal. The receiver shown in figure 26 in Wright et al. teachings is structurally very similar to the feedback loop of Cova transmitter 400 in figure 4.

Applicants argue on page 4 that one of ordinary skilled in the art would not be motivated to combine the teaching of Wright with the teachings of Cova since Cova teaches a trainer that operates when signals are being transmitted and Wright teaches training compensation circuits that operate when a signal is not being transmitted.

The Examiner's position is that Applicants' arguments are not persuasive. Applicants argue that Cova is directed to a trainer that monitors the actual data or voice transmissions need not to be interrupted (see page 4 of Applicants' arguments). In column 7 lines 5-15, Cova teaches in addition [Emphasis added], the trainer monitors the actual data or voice transmissions need not to be interrupted. In view of that, the trainer performs additional tasks. However, as recited in the last Office action, in column

7 lines 1-10, the trainer provides one or more "trainer" signals to the predistorter to update the predistorter's response to the in-phase and quadraturesignals input to the predistorter as the power amplifier's response changes due to temperature, age, etc.. In light of the foregoing teachings, the trainer as taught by Cova occasionally performs internal calibration to compensate for the power amplifier's response changes due to temperature, age, etc..

Referring to Wright et al. US Patent '896', as also recited in the last Office action, in column 4 lines 55 via column 5 line 10, Wright et al. teaches various techniques for stimulating the analog amplification chains and training the compensation circuits when no signal is being transmitted. In one embodiment, an antenna switch may be used to disconnect the antenna during application of the training signals to prevent unwanted emissions from the transmitter's antenna during training. The use of training signals in this manner allows the compensation/amplification chains to be brought into balance (or maintained in balance) prior to transmissions of information signals. In view of the foregoing teachings, Wright et al. performs calibration of the analog amplification chains prior to transmissions of information signals.

In view of the aforementioned discussion, Cova and Wright et al. teachings are in the same field of endeavor. Cova invention differs from Wright et al. invention in that Cova does not disconnect the antenna during application of the training signals to prevent unwanted emissions from the transmitter's antenna during calibration. Because the use of training signals as taught by Wright et al. allows the compensation/amplification chains to be brought into balance (or maintained in balance)

prior to transmissions of information signals, it would have been obvious for one of ordinary skill in the art at the time of the invention that Cova teachings can be modified such that an antenna switch to disconnect the antenna during application of the training signals, as taught by Wright et al., when no signal is being transmitted to prevent unwanted emissions from the transmitter's antenna during training..

Conclusion: for all the reasons as recited above, the Examiner maintains the rejection of claims 1-20.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 1, 4-6, 8-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cova U.S. Patent 6,141,390 in view of Wessel et al. U.S. Patent 6,275,685 B1 and Wright et al. 6,054,896.

Regarding claim 1,

Cova invention is related to a system for linearly transmitting an amplified output signal using predistortion. Even though the transmitter is mentioned throughout the invention, figure 4 illustrates a transceiver, including a transmitter and a receiver, implemented in Cova invention as appreciated by one of ordinary skill in the art. Cova does not teach that the transceiver operable in WCDMA

environment as claimed in the preamble and in body of the claim. Wessel et al. discusses in the background of the invention in another US patent in that the non-linear characteristics of a linear amplifier tend to produce interaction between the signals being amplified and the amplified output will contain intermodulation products, see column 1 lines 27-43. Wessel et al. further states that as systems migrate to wider band modulation, e.g. CDMA 2000 and WCDMA, a linearisation technique is required which is fundamentally a wide band technique and most implementations of pre-distortion are inherently wideband, see column 1, lines 62-67. Cova system differs from Wessel et al. discussion in that Cova does not disclose the system for WCDMA application. However, Cova teaches a system for linearly transmitting an amplified output signal using predistortion, which is inherently applied to wideband. In view of the foregoing discussion, it would have been obvious for one of ordinary skill in the art at the time the invention was made that Cova system can be modified to apply to wideband such as WCDMA. Motivation is because Wessel et al. discusses that predistortion technique known applies to wide band applications, therefore, one of ordinary skill in the art would have been motivated to apply Cova teachings to wideband applications, e.g. WCDMA.

Figure 6 illustrates a block diagram of the predistortion system including a transmit chain having a lookup table that provides filter coefficients to a digital predistortion filter 601. Figure 6 is a more detailed functional block diagram of the predistortion system 500 depicted in figure 5, wherein the predistorter 407 is

implemented with a predistortion filter 601 and a LUT 603 in figure 6. In view of that, the predistortion filter 601 corresponds to the digital predistorter as claimed in the instant application, and the LUT 603 corresponds to the claimed look up table in the transmit chain. In column 5 lines 45-60, see figure 4, Cova discloses the in-phase and quadrature component signals output by the modulator 403 are input into the predistorter 407. The predistorter 407 is operative to modify the in-phase and quadrature component signals output from the modulator 403 so as to compensate for any distortion that takes place in the power amplifier 103. In accordance with Cova invention, the predistorter uses a predistortion scheme that is not only dependent on the instantaneous power of the sample, but also on the power of the previous samples. A person of ordinary skill in the art will appreciate that the in-phase and quadrature component signals are used to calculate instantaneous power. As a result of that, the in-phase and quadrature component signals are power indicators, which are claimed in the instant application.

Referring to figure 4, in column 6 lines 58-67, a trainer 431, coupled to the transmission chain through the predistorter 407, receives the output signals from the digital quadrature demodulator 425 located on the receive chain of the transceiver in figure 4. The trainer 431 also receives the equivalent of the exact modulated signal (the output signals from the modulator 403) that was intended to be sent out, and the signal that was actually transmitted through the receive chain. In column 7 lines 1-7, the trainer provides one or more "trainer" signals to

the predistorter to update the predistorter's response. In view of the foregoing teachings, the trainer signals are a function of the signal that was actually transmitted, or equivalently is a function of the output of the transmit chain. The trainer signals also correspond to the claimed digital compensation signal. Referring back to figure 4, because the trainer subsystem 605 also receives the output signals (in-phase and quadrature component signals) from the modulator 403, the trainer employs both in-phase and quadrature component signals, corresponding to the claimed power indicators, and trainer signals, corresponding to the digital compensation signal as recited above, to provide the *inverse characteristics of the power amplifier* to the LUT 603, which provides filter coefficients to the predistortion filter 601 for reducing distortion in the output as claimed in the instant applicant. Finally, the trainer in Cova invention corresponds to the claimed predistorter training circuit.

- In regard to the limitations "*a predistorter training circuit, coupled to said transmit chain, that employs a receive chain of said WCDMA transceiver during a training mode to provide a digital compensation signal ...*",

In column 3, lines 25-35, Cova teaches in accordance with other aspects of the present invention, the ***direct inverse modeling scheme of the invention uses orthogonal signals for training***. In column 6 lines 25-35, see also figure 4, in order to aid in the accurate predistortion of the signal, the feedback loop monitors the amplified signal from the power amplifier 103. The coupler 419 is a conventional coupler positioned relatively close to the antenna 105 and is

operative to direct a relatively small portion of the output signal from the power amplifier 103 to the analog downconverter 423. Further in column 6 line 57 via column 7 line 10, Cova expresses that ***the trainer typically provides one or more "trainer" signals to the predistorter to update the predistorter's response to the in-phase and quadrature signals input to the predistorter as the power amplifier's response changes due to temperature, age, etc***. In light of the foregoing disclosure, Cova does teach the predistortion training circuit that employs a receive chain during a training mode to provide an update of the predistorter's response as the power amplifier's response changes due to temperature, age, etc, contrary to Applicants' arguments that <u>*Cova teaches a trainer that employs a signal that is a function of a transmitted signal during showtime but does not teach or suggest a predistortion training circuit that employs a receive chain during a training mode to provide a signal. In fact, the Applicants do not find where Cova discloses a training mode*</u> as stated on page 6 of Applicants' Remarks/Arguments.

Cova does not teach the antenna is disconnected from the transmit chain during the training mode.

Wright et al. discloses a very similar system as shown in figure 2 in which a LINC amplifier uses a digital control mechanism to control and adapt a digital compensation network that directly compensates for the imperfections of the analog RF environment, including the amplifiers. In column 4 line 55 via column 5 line 10, Wright et al. teaches in one embodiment that various techniques for

stimulating the analog amplification chains and training the compensation circuits when no signal is being transmitted. One feature of the invention involves applying training sequences to the compensation/amplification chains (the analog amplification chains and their respective compensation circuits) when no signal is being transmitted, such as during powering up and down of the amplifier and/or between burst transmissions. The use of training signals in this manner allows the *compensation/amplification chains to be brought into balance* (or maintained in balance) *prior to transmissions of information signals*. Wright et al. further teaches unwanted emissions from the transmitter's antenna are thereby substantially eliminated during training by using an antenna switch to disconnect the antenna during application of the training signals. Because the use of training signals as disclosed above allows the *compensation/amplification chains to be brought into balance* (or maintained in balance) *prior to transmissions of information signals*, it would have been obvious for one of ordinary skill in the art at the time of the invention that Cova teachings can be modified such that an antenna switch to disconnect the antenna during application of the training signals, as taught by Wright et al., when no signal is being transmitted. Such use of training signals allows the compensation/amplification chains to be brought into balance (or maintained in balance) prior to transmissions of information signals.

Cova does not explicitly teach in US Patent '390' that the transmitter includes a receiver. However, in column 4 lines 40-45, Cova teaches the linear

transmitter 400 in figure 4 is adapted for use as a paging transmitter in a paging system, although it can be used in any radio frequency (RF) application. In light of the foregoing teachings, one of ordinary skill in the art would have recognized that the linear transmitter 400 in figure 4 is part of a transceiver for transmission and reception. Furthermore, for practical reasons, one of ordinary skill in the art would have recognized that the feedback loop as taught in figure 4 of Cova invention employ a receiver as a feedback loop since the feedback loop would include the same components of a receiver. To reinforce the aforementioned reasoning, Wright et al., in column 34 lines 45-40, teaches that in order to implement the monitoring and correction mechanism a small amount of the output signal of the quadrature combiner is directed to a receiver, using a directional coupler as shown in figure 26. The receiver converts the RF signal down to complex baseband samples, which can be compared with samples of the ideal signal. The receiver shown in figure 26 in Wright et al. teachings is structurally very similar to the feedback loop of Cova transmitter 400 in figure 4.

Regarding claim 4, figure 12 illustrates a functional block diagram of the trainer 431 (see also figure 5) including a solver 1201, which processes a block of the stored data to generate the complex parameters used to update the LUT of the predistorter, see column 14, lines 17-29. In view of that, the solver 1201 corresponds to the claimed coefficient update circuit, and the filter coefficient updates (see figure 12) are representative of the claimed alternative power indicators.

Regarding claim 5, as recited in claim 1, the in-phase and quadrature component signals correspond to the claimed power indicators.

Regarding claim 6, Cova does not expressly disclose the trainer operates only in a training mode. However, in column 10 lines 47-54, Cova discloses the trainer subsystem *periodically* receives "batches" of data containing the modulation signal samples, power amplifier input signal samples, and power amplifier signal samples. The trainer subsystem 605 provides the inverse characteristics of the power amplifier to the LUT 603. In view of the foregoing disclosure, since the trainer subsystem *periodically* receives "batches" of data, the trainer also operates periodically to update the predistorter. Therefore, it would have been obvious for one of ordinary skill in the art at the time in the invention was made that the trainer can be considered to operate when it is needed, or equivalently in a training mode as claimed in the instant application.

Regarding claim 8, claim 8 and claim 1 are similar in scope. Claim 1 discloses components performing steps as set forth in claim 8. As result of that, claim 8 is rejected on the same ground as for claim 1.

Regarding claim 9, said claim is rejected on the same ground as for claim 2 because of similar scope.

Regarding claim 10, said claim is rejected on the same ground as for claim 3 because of similar scope.

Regarding claim 11, said claim is rejected on the same ground as for claim 4 because of similar scope. Furthermore, as recited in claim 1, the trainer employs both in-phase and quadrature component signals and provides trainer signals, corresponding to the claimed digital compensation signal, to generate the *inverse characteristics of the power amplifier* to the LUT 603, which provides updated filter coefficients to the predistortion filter 601. The updated filter coefficients are representative to the claimed alternative power indicators as claimed in the instant application.

Regarding claim 12, said claim is rejected on the same ground as for claim 5 because of similar scope.

Regarding claim 13, said claim is rejected on the same ground as for claim 6 because of similar scope.

4. Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Cova U.S. Patent 6,141,390 and Wessel et al. U.S. Patent 6,275,685 B1 as applied to claim 1 above, and further in view of Park et al. U.S. Patent 6,373,902 B1.

Regarding claim 2, referring back to figure 4 of Cova invention, the transmitter 400, comprising a transmit chain (the forward signal processing path)

and receive chain. The transmit chain comprises an digital interpolator 409 coupled to the output of the predistorter 407, a digital-to-analog converter 412 coupled to an output of the digital interpolator 409 through a digital quadrature modulator 411, an analog up-converter 413 coupled to the output of the digital-to-analog converter 412, a power amplifier 103 coupled to the output of the analog up-converter 413. Cova does not expressly disclose the analog upconverter 413 is a quadrature modulator as claimed in the instant application. However, in column 8 lines 13-35, the analog upconverter 413 receives two local oscillator signals provided by the synthesizer 435. In view of the foregoing disclosure, it would have been obvious for one of ordinary skill in the art that the analog upconverter 413 is a quadrature modulator because of the following reasons: first, outputs from the digital quadrature modulator 411 comprise in-phase and quadrature component signals; secondly, the analog upconverter 413 receives two local oscillator signals for upconverting the in-phase and quadrature component signals as appreciated by one of ordinary skill in the art.

Cova, however, does not disclose, an analog low pass filter coupled to an output of the digital-to-analog converter as claimed in the instant application.

Park et al. discloses a very similar device for linearizing a transmitter in a digital radio communication system having a predistortion lookup table storing predistortion data determined, in advance, the distortion characteristics of the transmitter with respect to input baseband data, see column 2, lines 55-64. Figure 1 illustrates a communication system using a typical predistortion

technique to compensate for distortion of transmission signal. In column, 3 lines 35-67, the system includes in the transmit chain a pre-distort RAM 21, digital to analog converters 15I and 15Q coupled to the pre-distort RAM 21, filters 25I and 25Q coupled to the D/A converters 15I and 15Q, a quadrature mixer 26 coupled to the output of filters 25I and 25Q, a power amplifiers 34. Figure 2 further shows filters 25I and 25Q being low pass filters.

Cova and Park et al. teachings clearly are in the same field of endeavor. Cova and Park et al. systems operate in similar manner. Cova teachings differ from Park et al. teachings in that Cova applies digital filtering on the base band signal in the interpolation stages. Park et al. uses analog low pass filters instead. As known in the art, low pass filtering is required in the transmit chain to remove spurious signal before the up-conversion, therefore, it would have been obvious for one of ordinary skill in the art at the time the invention was made that Cova predistortion system can be modified to add analog filters between the analog upconverter 413 and the DAC 412 as shown in Park et al.. The motivation is that low pass filtering is required at some point in the transmit chain to remove any spurious signal before the up-conversion.

5. Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Cova U.S. Patent 6,141,390 and Wessel et al. U.S. Patent 6,275,685 B1 as applied to claim 1 above, and further in view of Ha U.S. Patent 6,240,144 B1.

Regarding claim 3, referring to figure 4 in Cova invention, in column 8 lines 44-65, on the receive chain, the receive signal from coupler 419 is provided

to an analog downconverter 423 receiving two local oscillator signals provided by the synthesizer 435. Using analogous argument as for claim 2 above, the analog downconverter 423 is a quadrature demodulator as claimed in the instant application. Figure 4 further shows an analog to digital conversion (ADC) 424 coupled to outputs of the analog downconverter 423.

Cova invention does not show a low pass filter coupled between analog downconverter 423 and ADC 424. Ha discloses a similar apparatus and method of linearizing a power amplifier in a mobile radio communication system. As shown in figure 2, in column 6 lines 40-59, the receive chain includes a quadrature demodulator 144, low pass filters (LPFs) 146 148, and ADCs 150 152.

Using similar argument as for claim 2, Cova and Ha teachings are in the same field of endeavor. Cova and Ha systems operate in similar manner. Cova teachings differ from Park et al. teachings in that Cova does not show a LPF employed between the quadrature demodulator and ADC. Ha employs LPFs 146 and 148 between the quadrature demodulator 144 and ADCs 150 152. As known in the art, low pass filtering is employed to prevent aliasing by limiting the input signal bandwidth to below half the sampling rate, for that reason, it would have been obvious for one of ordinary skill in the art at the time the invention was made that Cova predistortion system can be modified to add analog LPF between the analog downconverter 423 and the ADC 424 as taught in Ha invention. The motivation is that aliasing phenomenon becomes a problem in A/D

conversion systems when an input signal contains frequency components above half the ADC sampling rate. The best approach to eliminate unwanted high frequency components and interference is to use a low-pass filter, which inhibits aliasing by limiting the input signal bandwidth to below half the sampling rate.

6. Claims 7 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cova U.S. Patent 6,141,390 and Wessel et al. U.S. Patent 6,275,685 B1 as applied to claim 1 above, and further in view of Miyashita U.S. Patent 6,288,610.

Regarding claim 7, Cova does not disclose a root raised cosine circuit provides the power indicator as claimed in the instant application.

Miyashita discloses in another US Patent the utilization of root raised cosine filters to pulse shape digital inputs (real part signal I and imaginary-part signal Q) of an apparatus shown in figure 3 for compensating distortion in the transmit signal. First, Cova and Miyashita are in the same filed of endeavors. Pulse shaping of digital signal is known in the art, therefore, it would have been obvious for one of ordinary skill in the art at the time the invention was made that Cova can be modify to implement root raised cosine filters to perform pulse shaping on the I and Q component outputs from the digital modulator 403 as shown in figure 4 of Cova invention. The implemented root raised cosine filters correspond to the claimed a root raised cosine circuit providing the power indicators (I and Q component signals). The motivation is that:

- First, in column 7, line 65 through column 8 line 2, Cova expresses the interpolation stages include digital filtering for pulse shaping the base band signals;

- Second, because digital signals (e.g. 0 and 1) are represented by pulses, which are not physically realizable since the pulses have rectangular bandwidth. Pulses do not have rectangular bandwidth may introduce intersymbol interference (ISI) between adjacent pulses at the receiver. A known technique for preventing ISI is the use of pulse shaping such as a root raised cosine filter whose pulse shape characteristics is very close to rectangular.

Regarding claim 14, said claim is rejected on the same ground as for claim 7 because of similar scope.

7. Claims 15-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cova U.S. Patent 6,141,390 and Wessel et al. U.S. Patent 6,275,685 and further in view of Park et al. U.S. Patent 6,373,902 B1, Ha U.S. Patent 6,240,144 B1 and Wright et al. 6,054,896.

Regarding claim 15, referring to figure 4 of Cova invention, as recited in claim 1, Cova system can be modified to apply to wideband such as WCDMA and the motivation is stated in claim 1 in view of Wessel et al.. The transmitter 400 in figure 4 comprises:

A transmit chain including:

A digital predistorter 407, wherein the digital predistorter 407 is implemented as a predistortion filter 601 and a LUT 603. The LUT 603 provided filter coefficients to the predistortion filter 601 based on power indicators as discussed in claim 1. In view of the foregoing discussion, predistortion filter 601 is equivalent to the claimed digital predistorter, and LUT 603 corresponds to the claimed lookup table;

A digital interpolator 409 coupled to the output of the digital predistorter 407, the digital interpolator 409 corresponding to the claimed interpolator;

A digital to analog converter 412, corresponding to the claimed digital to analog converter, coupled to output of the digital interpolator 409;

Cova does not teach employing a low pass filter as set forth in the claim. However, the combination of Cova and Park et al. teachings discuss the feature thoroughly in claim 2 above. The motivation is also stated in claim 2 above;

An analog upconverter 413, equivalent to the claimed quadrature modulator as discussed in claim 2 above, coupled to the output of the low pass filter as taught by the combination of Cova and Park et al. teachings as explained in claim 2 above;

A power amplifier 103 coupled to output of the analog upconverter 413;

A receive chain including: the claimed quadrature demodulator, a low pass filter, and an analog to digital converter are rejected in claim 3 above in view of Ha U.S. Patent 6,240,144 B1. Referring to figure 4 of Cova invention, the receive

chain further include a trainer, corresponding to the claimed predistorter training circuit, which is rejected in claim 1 above.

- In regard to limitations "*a predistorter training circuit, coupled to said transmit chain, that employs said receive chain during a training mode to provide a digital compensation signal …*",

In column 3, lines 25-35, Cova teaches in accordance with other aspects of the present invention, the ***direct inverse modeling scheme of the invention uses orthogonal signals for training.*** In column 6 lines 25-35, see also figure 4, in order to aid in the accurate predistortion of the signal, the feedback loop monitors the amplified signal from the power amplifier 103. The coupler 419 is a conventional coupler positioned relatively close to the antenna 105 and is operative to direct a relatively small portion of the output signal from the power amplifier 103 to the analog downconverter 423. Further in column 6 line 57 via column 7 line 10, ***Cova expresses*** that ***the trainer typically provides one or more "trainer" signals to the predistorter to update the predistorter's response to the in-phase and quadrature signals input to the predistorter as the power amplifier's response changes due to temperature, age, etc***. In light of the foregoing disclosure, Cova does teach the predistortion training circuit that employs a receive chain during a training mode to provide an update of the predistorter's response as the power amplifier's response changes due to temperature, age, etc, contrary to Applicants' arguments that *Cova does not teach or suggest a training mode as presently claimed where the antenna is*

disconnected from a transmit chain as defined in the specification as stated on pages 6-7 of Applicants' Remarks/Arguments. The Examiner disagrees because claim 15 does not recite the limitation "where the antenna is disconnected from a transmit chain". Nevertheless, as recited above, in order to aid in the accurate predistortion of the signal, the feedback loop monitors the amplified signal from the power amplifier 103; therefore, one of ordinary skill in the art would have been motivated to disconnect the antenna from the transmit chain. Motivation is to improve more accurate predistortion of the signal.

Cova does not teach the antenna is disconnected from the transmit chain during the training mode.

Wright et al. discloses a very similar system as shown in figure 2 in which a LINC amplifier uses a digital control mechanism to control and adapt a digital compensation network that directly compensates for the imperfections of the analog RF environment, including the amplifiers. In column 4 line 55 via column 5 line 10, Wright et al. teaches in one embodiment that various techniques for stimulating the analog amplification chains and training the compensation circuits when no signal is being transmitted. One feature of the invention involves applying training sequences to the compensation/amplification chains (the analog amplification chains and their respective compensation circuits) when no signal is being transmitted, such as during powering up and down of the amplifier and/or between burst transmissions. The use of training signals in this manner allows the *compensation/amplification chains to be brought into balance* (or maintained

in balance) *prior to transmissions of information signals*. Wright et al. further teaches unwanted emissions from the transmitter's antenna are thereby substantially eliminated during training by using an antenna switch to disconnect the antenna during application of the training signals. Because the use of training signals as disclosed above allows the *compensation/amplification chains to be brought into balance* (or maintained in balance) *prior to transmissions of information signals*, it would have been obvious for one of ordinary skill in the art at the time of the invention that Cova teachings can be modified such that an antenna switch to disconnect the antenna during application of the training signals, as taught by Wright et al., when no signal is being transmitted. Such use of training signals allows the compensation/amplification chains to be brought into balance (or maintained in balance) prior to transmissions of information signals.

Regarding claim 16, said claim is rejected on the same ground as for claim 4 because of similar scope.

Regarding claim 17, said claim is rejected on the same ground as for claim 5 because of similar scope.

Regarding claim 18, said claim is rejected on the same ground as for claim 6 because of similar scope.

Regarding claim 19, said claim is rejected on the same ground as for claim 7 because of similar scope.

Regarding claim 20, Cova does not teach the transceiver is located within a cellular phone as claimed in the instant application. However, as discussed in claim 1, Cova system can be modified to apply to WCDMA application. Because WCDMA is a technology for wireless cellular phone, it would have been obvious for one of ordinary skill in the art at the time the invention was made that Cova system can be implemented in a cellular telephone. Motivation is that cellular telephone is inherently a transceiver, and Cova teachings can be modified to use in cellular environment.

Conclusion

8. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Khanh Tran whose telephone number is 571-272-3007. The examiner can normally be reached on Monday - Friday from 08:00 AM - 05:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jay Patel can be reached on 571-272-2988. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

KCT

Khanh cong Tran 05/24/2006

Primary Examiner KHANH TRAN